

REMARKS/ARGUMENTS

Claims 1, 3-15 and 17-20 are pending in this application with claims 1, 17, and 19-20 being the only independent claims. Claims 2 and 16 have been canceled without prejudice or disclaimer. Independent claims 1 and 19 have been amended to recite features in original claim 2. Claim 12 has been amended to remove minor informalities. New independent claim 20 has been added, which is supported by original claims 11, 13-14, and 17.

No new matter has been added.

Overview of the Office Action

Claims 1-3, 5-8, 11-15, and 17-19 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over USP 6,185,240 to Jiang in view of JP 57093591 to Sawai.

Claims 4 and 9-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Jiang in view of Sawai, further in view of USP 6,639,931 to Dowd.

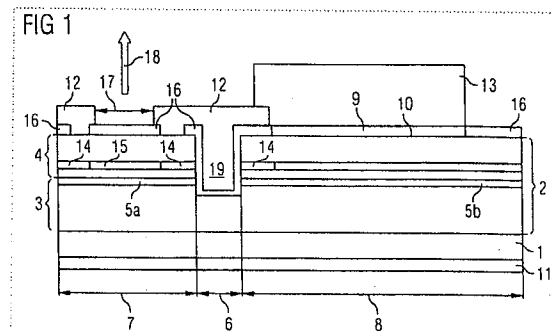
Claim 15 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Jiang in view of Sawai, further in view of USP 5,757,836 to Jiang (Jiang 2).

Summary of the Subject Matter Disclosed in the Specification

The following descriptive details are based on the specification. They are provided only for the convenience of the Examiner as part of the discussion presented herein, and are not intended to argue limitations which are unclaimed.

The specification discloses a light-emitting semiconductor component which contains a sequence of semiconductor layers (2) with an area of p-doped semiconductor layers (4) and an area of n-doped semiconductor layers (3) between which a

first pn junction (5a, 5b) is formed (see paragraph [0023], lines 4-7, of the published version of



the present application (US 2007/0258500)). The first pn junction (5a, 5b) is subdivided into a light-emitting section (7) and a protective-diode section (8) in a lateral direction by an insulating section (6) (see paragraph [0023], lines 7-9). In one example, the first pn junction (5b) in the protective-diode section (8) has a larger area than the first pn junction (5a) in the light-emitting section (7), such as by a factor of 100 (see paragraph [0023], lines 9-13).

The light-emitting semiconductor component also has an n-doped layer (9), which is applied to the p-doped area (4) in the area of the protective-diode section (8) (see paragraph [0029], lines 1-3). The n-doped layer (9) and the p-doped area (4) form a second pn junction (10) (see paragraph [0029], lines 3-4).

The protective-diode section (8) protects the light-emitting semiconductor component from voltage pulses due to electrostatic discharges (ESD) (see paragraphs [0030]-[0031]).

Patentability of the Claimed Invention

Independent claim 1 is not obvious over Jiang and Sawai

Independent claim 1 recites that “the first pn junction has a larger area in the protective-diode section than in the light-emitting section by at least a factor of 100.”

The above recited features of independent claim 1 are not taught by the combined Jiang and Sawai because of the following reasons:

- (i) the Office Action improperly limits Jiang’s light-emitting section to have the size of and be aligned with the orifice 122, instead of the section on the left of Jiang’s trench 133 as is shown in Fig. 1 of Jiang;
- (ii) the Office Action incorrectly defines the respective areas of VOSEL 103 and diode 105 based on Jiang’s teachings concerning the widths of the trenches 131 and 133; and
- (iii) above recited features of independent claim 1 are not merely based on an obvious optimization of ranges.

Jiang discloses a semiconductor laser with electrostatic discharge protection. In general, the laser device of Jiang is a vertical cavity surface emitting laser (VCSEL) 103 and is connected in parallel reverse orientation with a diode 105 (see Fig. 3, and col. 1, lines 39-42 of Jiang). The VCSEL 103 and diode 105 are fabricated on a substrate 101 and include stack 109, active layer 111, and stack 119 (col. 2, lines 20-30). Trenches 131, 133, 135, 137 are formed on the device of Jiang. Trench 133 defines the diode 105 and isolates diode 105 from VCSEL 103 and the rest of substrate 101 (see col. 2, lines 42-43). Furthermore, trench 133 is arranged on both the side of diode 105 facing VCSEL 103 and the side of diode 105 facing away from VCSEL 103 (see Figs. 1-2). The upper terminal of diode 105 is defined as portion 171 and the lower terminal of VCSEL 103 is defined as portions 161 and 163 (see col. 3, lines 65- col. 4, line 2). Thus, the diode 105 is limited to the portion of the stack 109 under terminal 171. As will be described in more detail below, the area of the pn junction in the diode is smaller than the area of the pn junction in the VCSEL 103.

The Office Action alleges that the first pn junction has a larger area in the diode section than in the VCSEL section. In Jiang the VCSEL 103 covers the section to the left of the trench 133 and, as described above, the portion of the stack 109 to the right of the trench 133 that is connected to terminals 161 and 163. The Examiner's interpretation of Jiang improperly limits Jiang's light-emitting section to have the size of and be aligned with the orifice 122, instead of the section on the left of Jiang's trench 133 as is shown in Fig. 1 of Jiang.

In supporting its position, the Office Action asserts that "light is blocked by bond pad" (see drawing illustration on page 21 of the Office Action). Without admitting or disputing such assertion, the bond pads do not limit the size of the pn junction that forms the active area region 115 in Jiang. Indeed, Jiang teaches that "when current flows, active region 115 is activated, thereby generating light which is reflected by stacks 109 and 119 for lasing and ultimately

emitted through orifice 122” (see col. 2, lines 38-41 Jiang). In Fig. 1 of Jiang, both the active region 115 and the mirrors 109, 119 are shown to extend over the entire region left from the trench 133 and thus act as a light emitting region.

Moreover, the specification of the present application defines that the light emitting section 7 covers more than just the light emitting opening (See Fig. 1 of the present application).

Therefore, Jiang’s pn-junction 115 has a smaller area in the diode section than in the VCSEL section and fails to disclose that “the first pn junction has a larger area in the protective-diode section than in the light-emitting section by at least a factor of 100” as recited independent claim 1. Accordingly, independent claim 1 patentably distinguishes over the combined Jiang and Sawai and is allowable for at least the above reasons.

Furthermore, independent claim 1 now includes the limitations of previous dependent claim 2. When rejecting claim 2, which is now included in independent claim 1, the Office Action refers to Jiang’s teachings concerning the widths of the trenches 131 and 133 and incorrectly using such trench widths to determine the respective areas of VCSEL 103 and diode 105.

In Jiang, the VCSEL 103 and the diode 105 are surrounded and thus defined respectively by trenches 131, 133. The widths of the trenches 131, 133 in Jiang however are not to be taken as the widths of the areas of VCSEL 103 and diode 105 or otherwise used to determine the areas of VCSEL 103 and diode 105. Consequently, given the teachings that the trenches 131, 133 each have a width between 0.1 μm and 1.0 μm , one cannot conclude that Jiang’s protective-diode area is a factor of 100 larger than Jiang’s VCSEL area. As an example, if room A and room B are surrounded by walls having a width between 0.1 cm and 100 cm, one cannot conclude that the area of room A is larger than the area of room B, much less by a factor of 100. Therefore, Jiang does not teach or suggest designing the area of the protective-diode 105 at least

a factor of 100 larger than the area of the light-emitting section located under the orifice 122, as is recited in independent claim 1.

Sawai was cited in the Office Action for the alleged teachings of a protective NPN junction but fails to disclose, teach or suggest what Jiang lacks.

Accordingly, independent claim 1 patentably distinguishes over the combined Jiang and Sawai and is allowable for the above additional reasons.

Applicants disagree with the Examiner's position that the above claim features of previous claim 2 are merely based on an obvious optimization of ranges.

In the device disclosed by Jiang, the VCSEL 103 and the diode 105 are placed reverse parallel. In the event of a reverse biased ESD, current is conducted only through the diode (see Fig. 3 and col. 4, ll. 6-29 of Jiang). The VCSEL 103 is thereby protected against reversed biased ESD. This effect is independent from the relation between the areas of the light-emitting section and the protective-diode section.

In the subject application, the pn-junctions portions 5a, 5b of the first pn junction 5 are connected in the same direction, i.e., in the reverse direction in case of an ESD voltage pulse in the reverse direction (see para. [0010] of the published specification). The protection of the light-emitting section is realized because most of the current flows through the protective-diode section because of its larger area. The relation of the areas of the light-emitting section and the protective-diode section thus allows the claimed light-emitting semiconductor component to carry out its intended function. Therefore, independent claim 1 cannot be regarded as a simple optimization of Jiang's parameters, as asserted in the Office Action.

Accordingly, independent claim 1 patentably distinguishes over the combined Jiang and Sawai and is allowable for the above additional reasons.

In view of all the above, withdrawal of the 35 U.S.C. § 103(a) rejection of independent claim 1 is respectfully requested.

Independent claim 17 is not obvious over Jiang and Sawai

Independent claim 17 recites that “the first pn junction in the area of the protective-diode section is short circuited.”

When rejecting independent claim 17, the Office Action refers to the electrically coupling conductive portion 169 in Fig. 1 of Jiang and asserts that such portion 169 would short-circuit the first pn-junction of the protective-diode section. To support the above conclusion, the Office Action interprets Jiang’s “protective diode section” to include all three narrow semiconductor stacks located on the right side of Fig. 1 of Jiang and separated by trenches. However, the Examiner’s interpretation of Jiang is incorrect as described in more detail below.

Applicants disagree because only the left one of these three semiconductor stacks of Jiang, i.e., the stack below upper terminal 171, can act as the diode 105. Among the three semiconductor stacks cited in the Office Action, only the left-side stack is electrically connected at its bottom and upper sides with electrodes. The middle stack is electrically insulated, while the right-side stack is short-circuited by the electrically coupling conductive portion 169 (see Fig. 1 of Jiang). The middle and right-side stacks thus are not shown to have electrical function as they are separated from the protective-diode section by trenches. Moreover, col. 3, line 67 - col. 4, line 2 discloses that the middle and right-side stacks of the three semiconductor stacks cited by the Examiner are connected to the VCSEL 103. Therefore, one skilled in the art would regard only the left-side stack (next to the reference numeral 105) as the diode section but not the middle and right side stacks.

In view of the above, one skilled in the art would not short-circuit the first pn junction in the area of the protective-diode section in view of Jiang, as is recited in independent claim 17.

Sawai was cited in the Office Action for the alleged teachings of a protective NPN junction but fails to disclose, teach or suggest what Jiang lacks. Independent claim 17 thus patentably distinguishes over the combined Jiang and Sawai. Withdrawal of the 35 U.S.C. §103(a) rejection of independent claim 17 is requested.

Independent claim 19 is not obvious over Jiang and Sawai

Similar to independent claim 1, independent claim 19 recites that “the first pn junction has a larger area in the protective-diode section than in the light-emitting section by at least a factor of 100.” Therefore, for similar reasons presented above, independent claim 19 patentably distinguishes over the cited art and is thus allowable.

New independent claim 20 is allowable

New independent claim 20 recites that “the insulating section is constructed as a trench bounded by an insulating layer” and “the trench is filled with a material forming a contact metallization.” The trench so formed has the advantage that the side walls of the pn junction and the insulating layer thereon in the trench are better protected against external influences, such as moisture or dirt.

Jiang does not teach the above recited features of independent claim 20. In fact, Jiang’s trench cannot be filled with such a material as recited in independent claim 20, because doing so would cause a short-circuit between the electrodes 145 and 169 of diode 105.

Therefore, new independent claim 20 patentably distinguishes over Jiang and Sawai and is thus allowable.

Dependent Claims 3-15 and 18

Claims 4, 9-10, and 15 depend, directly or indirectly, from allowable independent claim 1. The additional references are cited in the Office Action against the additional features in

claims 4, 9-10, and 15 but do not remedy the deficiencies of Jiang. Therefore, claims 4, 9-10, and 15 are each allowable for at least the same reasons that independent claim 1 is allowable.

Claims 3, 5-8, 11-14, and 18 depend, directly or indirectly, from allowable independent claim 1 or 17 and, thus, each is allowable therewith.

Conclusion

Based on all of the above, the present application is now in proper condition for allowance. Prompt and favorable action to this effect and early passing of this application to issue are respectfully solicited.

Should the Examiner have any comments, questions, suggestions or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Respectfully submitted,
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